Introduction

This map sheet with accompanying Geographic Information System (GIS) project is based on the original digital version of *Coal fields of the Conterminous United States* by Tully (1996), and also incorporates updated U.S. Geological Survey (USGS) national coal assessment information as well as information on Mesozoic (Triassic) coal basins in the eastern United States. Tully (1996) published a digital adaptation of Trumbull's *Coal fields of the United States, sheet 1* (1960), but in selected States he included newer information from published geologic maps. Due to changing technological and economic constraints for coal usage, along with the potential for geologic carbon dioxide sequestration, this map sheet and the GIS component of this report do not differentiate between potentially minable coal and uneconomic coal, unlike previous versions (Tully, 1996; Trumbull, 1960). The map sheet shows aerial extent, rank, province, name (region and field), and age information, which are also attributes of the GIS project accompanying this report. The shapefiles on which the map sheet is based were modified in ArcView 3.3, ArcInfo 7, and ArcGIS 9.3 and were subsequently imported into Adobe Illustrator CS5 using MAPublisher 8.3. The metadata file, Coal Fields of the United States_Metadata.docx, includes all sources and processing steps.

This report includes areas that were assessed by the USGS as part of the National Coal Resource Assessment (NCRA). The USGS, assisted by many of the State geological surveys, completed the new assessments of the top producing coal beds and coal zones in five major coal provinces—Eastern, Gulf Coast, Interior, Rocky Mountain, and Northern Great Plains. The assessments, which focused on both coal quality and quantity, utilized GIS technology and large databases. During the timeframe of the coal assessment (1999–2002), these five regions together

produced about 1,082 million short tons (mst) of coal annually, constituting 93 percent of the total U.S. coal production (Ruppert and others, 2002). Over 1,600,000 million short tons of coal remain in more than 60 coal beds and coal zones that were assessed (Ruppert and others, 2002).

The NCRA project differed in two fundamental ways from past USGS nationwide coal resource assessments by (1) utilizing digital databases and GIS and (2) focusing on both coal quantity and coal quality. All data and products were geographically referenced and stored, were manipulated digitally, and are publicly available for downloading. The sources of GIS shapefiles used for this report were USGS Professional Paper 1625–A (Fort Union Coal Assessment Team, 1999), –B (Kirschbaum and others, 2000), –C (Northern and Central Appalachian Basin Coal Regions Assessment Team, 2001), and –D (Hatch and Affolter, 2002); and American Association of Petroleum Geologists (AAPG) Discovery Series 14/Studies in Geology 62 (Warwick and others, 2011). The NCRA publications include (1) stratigraphic and geochemical databases for the fully assessed coal in each coal region; (2) maps showing coal extent, mined area, thickness and elevation of coal beds and zones, and overburden thickness; and (3) geochemical maps showing ash yield, sulfur content, calculated sulfur dioxide content per million British thermal units (SO_2/MBtu), calorific value, and selected trace elements. Each report discusses the geology, geochemistry, mining history, coalbed methane potential, and resources for each individual assessed coal bed and (or) coal zone, and also contains resource and geochemical tables. In addition to the data and text summaries, the NCRA final assessment reports include interactive GIS files that allow users to query data layers and view assessment results. The USGS coal resource assessments are designed to provide geoscientists, policymakers, planners, and

the general public with concise geologic information on the distribution, quantity, and quality of remaining coal resources in the United States. The resource estimates provide a means of comparing one assessment unit with another, and are useful for estimating the potential volumes of gas in the coal. The total resource tonnage number is large and is only a starting point for understanding how much coal is actually minable because of the many geologic, geochemical, economic, and technical restrictions that can be limiting factors to the ultimate recovery of coal from the ground (Ruppert and others, 2002).

Discussion

Figure 1 is a 1 : 5,000,000-scale map showing the conterminous United States divided into six coal provinces: Eastern, Interior, Gulf Coast, Northern Great Plains, Rocky Mountain, and Pacific Coast. Within each province, coal regions and individual coal fields are labeled. Coal regions are color coded to indicate the rank of the coal, which is explained in more detail in figure 6. Areas that were assessed by the NCRA are identified by red hachured polygons, and the assessment information was used to update certain region boundaries. Not all individual NCRA areas of assessment are shown in figure 1, but they are included in the GIS portion of this report. The Western Region of the Interior Province incorporated geologic outlines from Schruben and others (1998). In order to show all areas possibly having coal potential, the unassessed Triassic-age synrift basins on the East Coast are included in figure 1. The synrift basins are depicted as light blue-, green-, and purple-hachured polygons and were digitized from a Delaware Geological Survey publication (Benson, 1992). These basins have limited data and have not been assessed to the standards of the NCRA. They are included only to show the location of

potential coal resources and are qualitatively estimated as to their viability as future targets for exploration, which may lead to actual assessments.

Figure 2 is a 1 : 14,000,000-scale generalized map showing the geologic age of coal-bearing rocks in the conterminous United States. The map was created by incorporating data from Tully (1996), Schruben and others (1998), Benson (1992), and U.S. Geological Survey Geologic Names Committee (2010).

Figure 3 is a 1 : 14,000,000-scale map showing distribution of coal-bearing formations in the conterminous United States. They were extracted from the King-Beikman geologic map GIS (Schruben and others, 1998) by Laura R.H. Biewick (USGS), who selected formations shown by assessments to contain coal. Information on specific group names or depositional environment is given where available (Biewick, written commun. 2002). The outlines in figure 2 are based on tectonic basins, while the outlines in figure 3 are based on surficial geologic formations (cropping out at or near the surface). Figure 3 was digitized at a more detailed scale than figure 2, so the outlines may not match. The ages of the formations shown in figure 3 represent surficial geological units, whereas ages shown in figure 2 are for coal-bearing units that may be stratigraphically lower.

Figure 4 is a 1 : 18,000,000-scale map showing annual coal production by State in the conterminous United States for 2009, in millions of short tons. This figure is based on U.S. Energy Information Administration (2010); 2009 was the most recent year for which statistics were available at the time of publication.

Figure 5 displays annual coal production for the conterminous United States from 1949 through 2009, and shows the overall upward trend in coal production since 1960. Table 1 lists annual coal production by State for the conterminous United States for 1985, 1986, and 1990 through 2009. Figure 6 is a chart showing the basis for classifying coal by rank in the United States. Approximate rank is based on American Society for Testing and Materials (ASTM) standard D388-05 (ASTM International, 2005).

The GIS component of this report contains polygon, line, and point shapefiles of the data used to create figures 1, 2, and 4. The ArcGIS project contains (1) shapefiles of the coal fields with their rank, province, name (region or area), and age; (2) shapefiles of the Triassic basin outlines and their coal potential; (3) shapefiles of the coal provinces of the conterminous United States; and (4) point files for labeling the individual fields. From the NCRA assessment, only shapefiles for outlines of individual assessment units, with isopachs of coal thickness and overburden, are included in the GIS project of this report.

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